

Proposed FY16 Regional Applied Research Effort (RARE) Study

Project Title: Differences in Br species, burning emission factors, and residual ash concentrations between non-contaminated and MeBr-contaminated straw.

PROJECT SUMMARY

Statement of Problem:

Twenty-six farms fields in ID containing the Pale Cyst Nematode were treated with Methyl Bromide (MeBr). MeBr breaks down in the soil and shows up as residues of inorganic bromide; these residues accumulate in some crops. Baled hay and crop residuals (straw) grown in the previously MeBr treated fields have high levels of bromide. The inorganic bromide in livestock feed has been linked with adverse effects, leaving farmers in a quandary as to how to get rid of the inorganic bromide residues and return their fields to full production. One possible method of treatment is to conduct open field burning to remove crop residues, a common practice used in the Northwest to prepare fields for subsequent planting. It is unknown what constituents may be in the emissions or remaining ash from burning the contaminated plant material. Like other halogens in biomass, bromine will be partitioned in various forms between emissions and the ash. This research will determine ash residues and emission factors for Br species for uncontaminated and contaminated straw, so that growers and regulators can determine if any unacceptable risks exist.

Research Approach:

Region 10, with the Idaho Department of Agriculture and APHIS, will determine the reasonable worst-case biomass of concern based on likely crops to be planted, existing information on residues in different crops, and crop/straw availability in the late summer/early fall timeframe. ORD will determine the likely amount of biomass needed for combustion tests in order to reach acceptable levels of detection. APHIS will gather the selected biomass (both contaminated and uncontaminated for the same crop species), test for inorganic bromide concentrations, and ship to ORD's Research Triangle Park Open Burn Test Facility (OBTF). ORD will recreate the field conditions for the test burning in the OBTF. Analyses for multiple combustion products (CO, CO₂, PM_{2.5}, VOCs, BC, Br₂, HBr, MeBr, Br-organics) will be undertaken as well as Br compounds in the ash from burning control (uncontaminated) and inorganic bromide contaminated material.

Anticipated Results and Regional Impact:

The Region 10 goal is to allow farmers to restore their fields to production as well as remove the inorganic bromide safely from the fields. The results of this proposed research work will be used by the Idaho regulatory partners to determine if there are any unacceptable risks associated with open burning, and what the next steps will be. This issue is of critical important to the farmers in Idaho whose fields are contaminated with inorganic bromide. There are approximately 2,300 acres and 26 farm families affected. Their ability to safely and economically raise crops on the affected fields has been compromised. Many are suffering significant financial losses which could continue for many years into the future. The answers from this research project could help farmers remediate their fields and remove inorganic bromide residues and could help reduce the costs of disposal of straw and other crop residue. EPA has a critical role in supporting these family farmers and our state and federal partners by providing answers on whether crop residue burning can be done safely.

Anticipated Final Products:

The Final Report will discuss the differences between the Br species emissions factors and residues in ash from open field combustion of uncontaminated and inorganic bromide contaminated biomass. The report will be the basis to discuss potential next steps to evaluate health concerns from the

emissions and identify the potential fate of residues in ash.

PROPOSED PROJECT SCOPE

Background: Growers at 26 farms in Idaho can no longer farm in their traditional manner due to the Pale Cyst Nematode infestation and due to inorganic bromide accumulation into crops, straw and hay. In some cases parts of the crop could have low inorganic bromide residues and be sold into the commercial market while the remaining plant material and straw could still be contaminated by the inorganic bromide that was used in soil to control the pale cyst nematode. Planting wheat/barley grain (which has low inorganic bromide accumulation in the grain itself) followed by straw residue removal helps remove inorganic bromide from the fields. The number of crop cycles necessary to sequester and remove the inorganic bromide residues is uncertain but it will probably take many years for residues to drop to acceptable levels. Like other halogens in biomass, bromine will be partitioned in various forms between emissions and the ash. This research will determine ash residues and emission factors for Br species for uncontaminated and contaminated straw, so that growers and regulators can determine if any unacceptable risks exist.

Project History: Research by other agencies in the summer of 2016 will determine inorganic bromide uptake into a variety of crops. The goal of that research is to identify a menu of crops suitable to the growing conditions of eastern Idaho that do not take up inorganic bromide into the edible portions of the plant. Previous sampling of crops and soil have indicated some crops biomagnify high levels of inorganic bromide, especially in wheat and barley plant material and straw, and alfalfa hay.

Research Objectives:

The research objective is to determine if burning of agriculture and crop residues on fields contaminated with inorganic bromide can be done safely. The study will evaluate the incremental risk from agriculture burning of inorganic bromide contaminated fields vs. agriculture burning of uncontaminated fields. The study will evaluate and identify what products are in the emissions and ash from a laboratory test burn.

Research Approach:

Crops: EPA Region 10 continues to work with State and Federal Partners to determine crops of concern based on likely crops to be planted. Final selection of exact crop residues and conditions is under discussion with IDEQ, APHIS, and ISDA. ORD will determine the amount of biomass that is needed for combustion tests. APHIS will gather selected biomass (both contaminated and uncontaminated of the same crop species), test for inorganic bromide concentrations, and ship to ORD's Research Triangle Park Open Burn Test Facility (OBTF).

Combustion Testing: ORD will recreate the field conditions for the test burning in the OBTF. Up to 7 types of combustion products may be analyzed in the emissions and ash from burning control (uncontaminated) and inorganic bromide contaminated material. A tradeoff between the number of crop types to be tested, the number of replicates, and the emission species to target will be discussed.

Potential Risk: The Final Report will discuss the differences between the Br species emissions factors and residues in ash from open field combustion of uncontaminated and inorganic bromide contaminated biomass. The report will be the basis to discuss potential next steps to evaluate health concerns from the emissions and identify the potential fate of residues in ash.

ORD Project Update:

ORD conducted test burning for emission samples of treated and untreated alfalfa in EPA's Open Burn Test Facility (OBTF). Testing was conducted in late fall 2016. ORD has developed a draft update report summarizing the testing results. The draft report is currently going through internal quality assurance reviews. The following is a summary of the testing results and recommendations outlined in

the draft update report.

For all but fine particulate matter (PM_{2.5}), measured emissions were lower for the untreated biomass. Since the treated and untreated biomass were from a different alfalfa source and may have different ages and moisture conditions resulting in different combustion behavior, this represents an imperfect comparison. The concentration of Br⁻ ion in the biomass ash doubled. Tests simulating an air curtain incinerator resulted in less ash (better burnout). Follow-up tests to measure emissions under these conditions resulted in minimal flaming combustion and prolonged smoldering which blinded the baghouse with a tarry soot. These results suggest that if improved combustion can be accomplished in an air curtain incinerator, perhaps with a fuel assist burner and higher temperatures, better burnout could be achieved in comparison to an open field burn scenario. This approach would remove the bromide ion from the field, concentrate it in the ash for landfill disposal, and remove its potential for subsequent crop uptake.